AN

IMPROVED METHOD

OF

DIFFUSING ANTISEPTICS

IN

DRY AIR

FOR

INHALATION, DISINFECTION, AND ANTISEPTIC SURGERY.

PARTLY REWRITTEN AND EXTENDED FROM THE LANCET.

BY

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Sir,

I venture to address these lines to you, from a conviction that all that relates to antiseptics, whether used as simple disinfectants, as part of the great system of antiseptic surgery introduced by Professor Lister, or as inhalations for the relief of ordinary catarrhs and muco-purulent affections of the throat and chest, of croup and diphtheria, or for the destruction of the tubercle bacilli, and, as I hope, the radical cure of early cases of phthisis, must be of intense interest and importance to every member of the medical profession; and I think it will be allowed that the amount of water, necessarily used in all steam and spray machines, is in many cases a serious impediment to their utility, and also that the system of dry inhalation, as at present used, is far from satisfactory, from the very unvolatile nature of those antiseptics best adapted for inhalation—I mean carbolic acid and creasote; and though I have seen very satisfactory results clinically, from the continued inhalation of these antiseptics, in the oro-nasal inhaler of Dr. Hunter Mackenzie, and have, thanks to the kindness of my colleagues here, Dr. Daubeny and Dr. Freeman, been able to observe the sputa of patients under their care, as well as under my own care, and have observed that, with continued and constant inhalation, the bacilli do diminish in relative number, disappear, reappear in diminished numbers, and again disappear, over and over again, and at last, I believe, altogether cease; still, I am aware that the actual amount of carbolic acid or creasote thus inhaled is very small, and I believe that a stronger inhalation, in the dry form, of these well-tried antiseptics must be of great value to every member of the pro-

fession, and that every surgeon will, having felt the inconvenience to himself, and the occasional danger to his patient, from the wet sprays used in antiseptic surgery, be glad to know of a method by which almost every antiseptic, in ordinary use, can be used in dry air. I shall now proceed briefly to relate the simple experiments on which the system I advocate is founded, and shall then describe the method of application, first, to inhalation; second, to disinfection and antiseptic operations as a substitute for the spray.

1. I exposed 15 minims of carbolic acid in a watch-glass to the air of a room in summer, and at the end of twenty-four hours I was unable to detect any alteration in the weight.

2. I similarly exposed the same quantity in a water-oven, heated and kept to a temperature of 160° to 170° Fahr., the result being, that at the expiration of five hours the carbolic acid had entirely disappeared, not even a stain being left on the watch-glass.

3. I exposed the same quantity, similarly in a water-oven, to a temperature of 200° Fahr., with the result, that at the end of two hours the carbolic had entirely disappeared.

Being satisfied by these experiments that, by the application of heat, carbolic acid could be vaporised and diffused in dry air, I had an instrument constructed, consisting of a tin boiler, closed except at one point, where a tin funnel was inserted, both for filling the boiler and also for inserting a thermometer to ascertain the temperature of the water. Inside this boiler was coiled a metal tube, having an internal diameter of half an inch, and a length of between eight and nine feet; the lower end of the pipe pierced the side of the boiler and projected six inches; the upper end was expanded into a chamber one and a half inch in diameter and one inch deep. To this was fitted a hollow metal plug, connected, by eighteen inches of three-quarter-inch india-rubber tube, with an ordinary oro-nasal face-piece, provided with valves so arranged that all inspired air had to pass through the tube, all expired to escape at the sides.

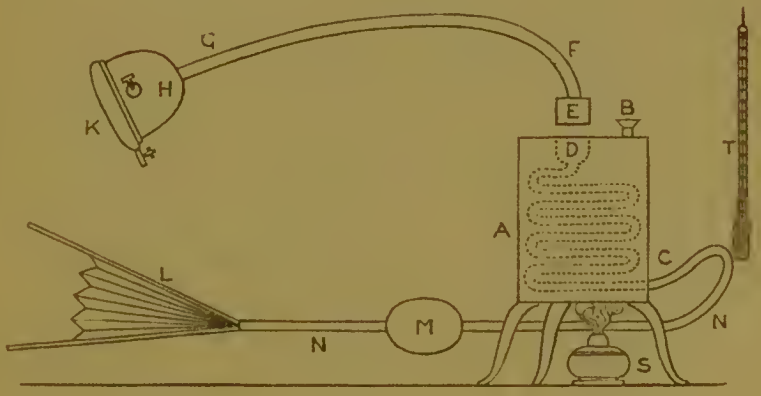
I now tried the following experiments:—

1. On 8 grains of tow I placed 13 grains of carbolic acid,

DIAGRAM AND DESCRIPTION OF THE ANTISEPTIC INHALER AND VAPORISER,

RECOMMENDED BY

MR. LIONEL E. KAY SHUTTLEWORTH.



A is the tin cylindrical boiler; B, the funnel for filling it and for inserting T, the thermometer; C to D, the ½-inch metal tube coiled inside the boiler; C, the open projecting end; D, the expanded end or chamber into which the hollow plug, E, fits tightly; E receives the tow saturated with the antiseptic, and is connected by a short curved piece of metal pipe, F, with the india-rubber tube, F–G, ¾ of an inch in diameter, which serves, either to direct the stream of antiseptic air directly on to the surface to be operated on, or into the oro-nasal face-piece, H, which is provided with valves of entrance and exit, and with an air-pad round the edge, K; S is a spirit-lamp; L is a pair of bellows; M, an elastic ball to equalise the current of air; and N N, an elastic tube, connecting the bellows L with the ball M, and with the metal pipe C, when the apparatus is used for surgical or disinfecting purposes, but not connected during direct inhalation.

The machine may be obtained from

MESSRS. MAW, SON, AND THOMPSON,

11, ALDERSGATE STREET, LONDON.

making a total weight of 21 grains. I then placed the saturated tow in the hollow plug, and the plug in the chamber, filled the boiler with hot water, and lighted the lamp, and commenced inhaling with a temperature of 170° Fahr. After ten minutes' inhalation the total weight was reduced to 13 grains ; after twenty minutes, including the time occupied by the first weighing, to 8 grains; and after thirty minutes, to 8 grains; at the end of the half-hour the temperature was 198°, thus showing that 13 grains of carbolic acid had been vaporised in about twenty minutes in hot dry air.

2. I next fitted to the lower projecting end of the tube an ordinary small pair of bellows, by means of 6 inches of india-rubber tube, and placed 12 grains of creasote on 7 grains of tow in the chamber, and in seven minutes, with a temperature varying between 160° and 170° Fahr., entirely dispersed all the creasote through the air of the room, by slowly driving a stream of air through the heated pipes.

I made many other experiments with thymol, eucalyptus oil, etc., with equally satisfactory results, and proved to my entire satisfaction, that, by passing heated air through tow saturated with carbolic acid, creasote, thymol, eucalyptus oil, etc., the heated air could itself be highly charged with these powerful antiseptics, without the aid of any watery vapour, and that the strength of the air solution, if I may, for want of a better, use that term, could be regulated easily by the temperature of the water in the boiler. The higher the temperature was raised, the more rapidly the antiseptic was given off, and the greater was the strength of the air solution, and *vice versâ*.

The apparatus may be used in three ways :—

1. For direct inhalation, as in the first experiment.

2. For inhalation, disinfection, or antiseptic operations, by charging the air of a room, as in the second experiment.

3. Directly for operations, where the aqueous spray is objectionable, by using the bellows, and directing the stream of antiseptic air directly on to the seat of the operation, through a large india-rubber tube, fitted to the chamber by a

hollow plug, similar to that employed to connect the oro-nasal face-piece.

Further applications of the same principle are obvious; thus, by a similar arrangement of a larger tube coiled in a boiler, all the air entering a hospital ward might be both warmed and rendered antiseptic, a rotatory fan replacing the bellows, and causing a constant stream of dry heated antiseptic air.

Clothes and other articles requiring disinfection, placed in a chamber, could have a constant stream of heated and strongly antiseptic air driven through them, at any temperature up to 212° Fahr., with a water-boiler, and at much higher temperatures with an oil boiler; the temperature being perfectly under control, with the latter, from the ordinary temperature of the air up to the boiling point of oil.

I think the foregoing remarks and observations have clearly shown, that carbolic acid and other antiseptics can be easily used suspended in dry air, and I believe that no plan has hitherto been suggested, by which they can be, so easily and certainly, used in this manner; and while I hope that in time more efficient methods may be suggested, I believe the principle of passing hot air through a permeable substance, charged with the antiseptic, will be found a very efficient method of using disinfectants and antiseptics, and will in many cases be found very superior to all steam and spray inhalations, and also to surgical sprays, where the large amount of moisture is often found most objectionable, obscuring the sight of the surgeon and soaking the clothes of the patient. For the purpose of inhalation, a mixture of creasote and carbolic acid appears to me to be most suitable. I direct the pure crystal of carbolic acid to be dissolved by heat, and mixed with fluid, with an equal quantity by measure of creasote. To this I usually add a small quantity of chloroform, say of carbolic acid and creasote, each ℥i, of chloroform ℥js.

I direct that 20 minims of this mixture shall be dropped on to the tow; the chloroform, being first given off, soothes the throat and renders the inhalation pleasant. I commence

with a temperature in the boiler of 145° to 150° Fahr., raised by the spirit-lamp, till the air is so highly charged as to irritate or cause cough; the lamp being then withdrawn, the inhalation can be continued, till all the antiseptic is expended, or for the length of time prescribed; more antiseptic can, if desirable, be added from time to time.

And now as to the use of antiseptic inhalations. I believe this to be entirely, or almost entirely, preventive; that is to say, that when in an early case of phthisis, mucco-purulent matter is secreted, from at first only a small portion of the lung, I believe, small portions of this discharge get carried by the to-and-fro motion of the air, and the general movements of respiration, first into other adjacent portions of the same lung, supplied by branches of the same bronchial tube which supplies the original focus of disease, and then, by degrees, into more and more distant parts of the lung, and into the opposite lung; and I believe, by the constant use of antiseptic inhalations, especially dry ones, that the antiseptic air can be made to penetrate to the smaller divisions of the bronchial tubes, and that a considerable part of the antiseptic will be absorbed by the moist membrane, lining these bronchial tubes, and pass, possibly, on to the alveoli; and that thus, all purulent secretions escaping, will, as they spread, be more and more thoroughly mixed with antiseptic fluid, and that the parts which have been bathed with the antiseptic air, and have absorbed antiseptics from the air, will themselves be unfavourable breeding places for purulent material and bacilli. And at the same time, I believe that the antiseptic atmosphere will exercise a beneficial influence on any vomicæ into which it can enter, stimulating their walls to healthy action, and preventing the putrefaction of their contents. As to the actual destruction of bacilli, I am doubtful; I believe young bacilli may be destroyed, but I doubt whether the spores contained in the older bacilli about to divide, and which give them their beaded appearance, can be destroyed by anything short of fire, or thorough carbonisation with strong acids. Hence I believe, the successive crops of bacilli are due to the develop-

ment of separate deposits of spores; and it seems probable, that spores carried into alveoli, there germinate, cause proliferation of the lining epithelium, and the formation of tubercle; and that, on the breaking down of these tubercles, the bacilli are set free in great numbers, and again distributed to fresh portions of the lung, where, forming spores, they complete the vicious circle. I have heard grave doubts expressed as to the possibility of the infective theory of phthisis, on the ground that, if the disease is caused by the entrance of spores or bacilli, the wonder is that everyone does not take the disease; but I think the wonder rather is, that the spores or bacilli ever penetrate far enough into the air-passages to do any harm. In most people, any irritant inhaled is at once rejected, and it is only in exceptional cases, that even the pollen of grass produces hay-fever in the form of catarrh, and, in still more exceptional cases, asthma. As a rule, probably the irritant is deposited on the moist mucous surfaces of the nostrils, and at once excreted without causing any inconvenience.

I remain, Sir, yours faithfully,

LIONEL E. KAY SHUTTLEWORTH.

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